myDR: Improving the Self-Care Process for Caribbean Patients with Diabetes through Mobile Learning

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Abstract

Diabetes self-management education plays a vital role in the treatment of people living with diabetes. This paper focuses on a new channel for the delivery of personalized diabetes education for Caribbean patients– the mobile phone. It discusses how mobile learning can be used to improve the self-care practices of patients with diabetes. It presents a mobile application called myDR (short for my daily record) that is used to retrieve and store the blood sugar and blood pressure levels of a diabetic patient. The system is designed to utilize the patient's current and previous readings along with the patient's health context to deliver diabetes self-management education using the mobile phone. The results of a usability study on the application are also presented and the majority of the participants found this system to be an improvement of their current diabetes education programme. Furthermore, they valued the need for more relevant and timely information which is afforded by this new medium.

Keywords

Mobile Learning, Diabetes Education, Mobile Telemedicine, Personalization

INTRODUCTION

Chronic non-communicable diseases account for almost 60% of all deaths worldwide. Diabetes, in particular, is a major non-communicable disease in the Caribbean region. The high prevalence of this disease can be attributed mainly to the inadequate healthcare infrastructure in the region as well as poor patient self-care practices (Douglas, 2007).

Many of the approximately thirty countries in the region are considered less developed, with their population living at poverty levels well below the world average. The public healthcare systems in Caribbean countries currently face a crisis due to factors such as shortages of medical staff, lack of proper facilities, insufficient funding and poor patient self-care practices. Therefore, new approaches to managing healthcare and promoting healthier lifestyle practices are needed to address this problem.

This research focuses on the design and development of a patient interface using mobile telephony called myDR (short for my daily record) to address some of the existing shortcomings of the present patient self-care practice. It makes use of mobile learning as a means of improving patient self-care management by providing a new channel for educating the patient on better lifestyle choices. Given the high prevalence of Type II diabetes in the Caribbean region, the system focuses on this category. This application is one of the components of the Caribbean-wide Healthcare Management System called MediNet (Mohan et al, 2008) currently being developed by researchers at The University of the West Indies.

RELATED WORK

Diabetes self-management education is the process of coaching people on how to control their diabetes. The objectives are to ensure the patient has better control over his blood glucose level, to prevent complications relating to diabetes and to improve the patient's overall quality of life (De Weerdt et al, 1989). Research (Noriss et al, 2002) has shown that most of the present education initiatives have involved programmes at community gathering places, at the home, in camps, schools and in some cases the worksite.

Community based initiatives often offer the benefit of cultural relevancy. Each culture may have a different learning style that can be catered for in a community setting. Interventions that take place in the home involve an educator visiting the home to assess and address diabetes related issues with the patient that may be more challenging to attend to in a clinical setting. Diabetes self-management education in camps focuses on the use of summer camps for adolescents with Type I diabetes. The objective is to educate the children on personal responsibility for the care of their disease while providing them with a traditional camp experience. Interventions at the worksite make it easier for people with diabetes to attend while including their supervisor, managers and colleagues who may also gain from the knowledge.

The use of mobile telephony as a channel for diabetes self-management education is a recent trend. (Longoria, 2001) explains that mobile phones have four characteristics that make them suitable as a new health care platform: personal, ubiquitous, connected and increasingly intelligent. Since each phone is associated with a person, applications can be customized and personalized to suit. Mobile users can also monitor their health on the go, anywhere and anytime. Lastly, the connectivity and networking capabilities allowed by these devices can also harness the benefits of community based interventions.

Many systems have been developed to address the need for proper health care self-monitoring and recording through the use of mobile phones (Becker et al, 2004 & Holopainen et al, 2007). However, not much research has been conducted on the use of mobile phones as a channel for health care education. The myDR application addresses this area.

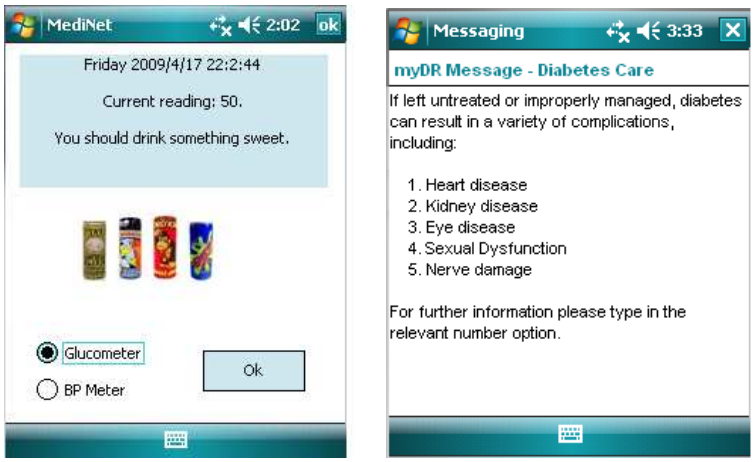
MYDR APPLICATION

Figure 1. myDR Application Main Menu Screen Shot

The myDR is a mobile application that allows the user to enter and record their readings obtained from the selected glucometer and blood pressure meter. The application was developed for the HTC Touch (HTC Corporation, 2009) Smartphone and uses the LifeScan OneTouch Ultra Meter (LifeScan Inc., 2009) with the Polytel Wireless Glucose Meter Accessory (PolyMap Wireless, 2008) and the A&D blood pressure meter (A&D Company Ltd., 2009).

Figure 1 displays the graphical user interface of the myDR application. It contains the options such as *Get Readings* from meter, *Edit User Date* to update the patient's profile, *View Log Book* of previously measured readings in the form of tables and graphs, *View Tip* to advise the patient regarding the accumulated measurements, and the Get *Help* feature provides the user with instructions on how to use the system.

The education component provided through the system is personalized to individual patients taking into consideration the current readings obtained from the patient, historical readings stored in a patient model, and knowledge areas about diabetes stored in a content knowledge base. Algorithms determine what knowledge area to focus on given the current situation of the patient. Personalization is also done at the group level where diabetes related information is sent to all users of the myDR application via SMSs. The group level education allows for the delivery of information that is relevant to all members of the target group, for example, nutrition data on local foods. Figure 4 illustrates an example of individual feedback received after a reading and a group SMS relating to diabetes education.



(a) (b)

Figure 2. (a) myDR Individual Feedback (b) myDR Goup SMS

EXPERIMENTAL DESIGN

The deployment of the system is broken up into six stages: (1) usability testing of the myDR application with 15-20 patients, (2) infrastructure testing with 15-20 patients in Trinidad and Tobago (3) clinical trials with 150-200 patients in Trinidad and Tobago, (4) system made available in Trinidad and Tobago, (5) clinical trials with 150-200 patients from the wider Caribbean region and (6) system made available in Caribbean region. This paper focuses on the first phase of the deployment, the usability testing.

The aim of the usability testing was to directly test the hypothesis that diabetes-centered mobile learning will improve the self-care practices of the patients living with diabetes. To test the hypothesis, the myDR mobile application was used.

The participants were invited to the study on a volunteer basis. Table 1 shows a summary of the participant profile. At the start of the study the objectives and confidential nature of the study were

explained and each participant signed a consent form. Two questionnaires were administered to the group at the beginning of the trial. The first questionnaire was used to gather information on the participant's current health care process (if any) and the second questionnaire was used to obtain information on the participant's mobile phone usage.

During the study there was an independent observer who recorded all of the participants' feedback. All participants were asked not to talk to the observer during the trial and use the think aloud approach when navigating through the system. The users were observed as they interacted with the system and all observations were recorded, including any challenges faced.

Table 1. Participant Profile

Diabetes	Type II	**Owns Glucometer**	6
Age Range	45-70	**Owns Blood Pressure Meter**	6
Gender	4 Males and 11 Females	**Non Mobile Users**	3
Residence	Trinidad and Tobago		

RESULTS AND DISCUSSION

The objective of the user study was to obtain some preliminary feedback on the usefulness and feasibility of the myDR mobile learning initiative.

73.33% of the participants were inclined to use the system as a channel for diabetes education. The other 26.67% had no preference. The most popular reasons for using the system were: "availability, almost everyone owns a mobile", "easy to use" and "the information provided was meaningful and relevant to the patient." All the participants, with the exception of one, were not enrolled in any formal diabetes education program. One participant was a member of her local diabetes association and attended meetings every three months.

Most of the participants obtained their health care education from their health care provider, TV shows and articles. The participants also unanimously agreed that the system will improve their self-care process. They especially liked the idea of the reminder feature to take their next reading as well as the feedback obtained on each reading. Timely feedback was important as it kept them motivated in maintaining their self-care regime.

FUTURE WORK

The next stage of the project is on the way. This involves the testing of the different information technology components of the MediNet system: health care devices, mobile phones, telecommunications infrastructure, and server-side processes. The clinical trials are expected to begin in November 2009.

CONCLUSION

Research has shown that diabetes self-management education is effective in the treatment of diabetes. The ubiquity of the mobile phone and the fact that it is available anywhere and at anytime makes it a good candidate for health care education initiatives. This paper presents results of a usability study conducted for a new mobile learning application called myDR. The myDR application provides a new channel for the delivery of diabetes education. The application provides education both at the individual and group level. The results of the user study show that the majority of participants preferred this system over their existing diabetes education programme. Moreover, the participants believed that the relevance and timeliness of the information delivered contributed to its effectiveness. Future research on the application will involve the utilization of appropriate visualization techniques which will exploit the capabilities of the mobile device.

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